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NATIONAL DAM SAFETY PROGRAM. ROBERT SCHULTE DAM (MO 10497), MIS--ETC(U)
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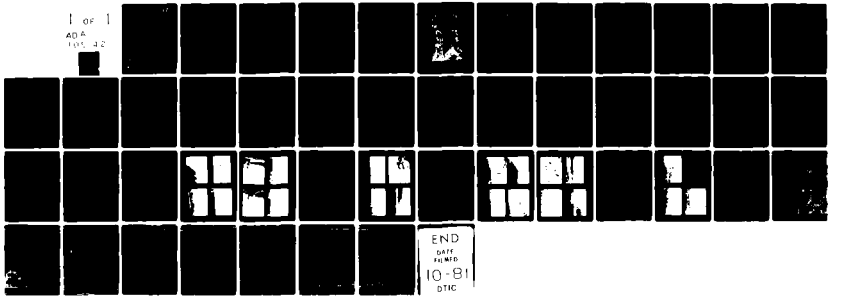

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MISSISSIPPI-KASKASKIA-ST. LOUIS BASIN

ROBERT SCHULTE DAM

ST. CHARLES COUNTY, MISSOURI

MO 10497

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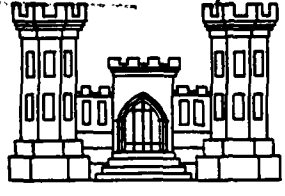
PHASE 1 INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM.

Robert Schulte Dam, (MO 10497),
Mississippi - Kaskaskia - St. Louis Basin,
St. Charles County, Missouri.
Phase I Inspection Report.



PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

DECEMBER 1978

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Robert Schulte Dam, MO ID No. 10497
Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Robert Schulte Dam:

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 10 percent of the Probable Maximum Flood.

2) Overtopping could result in dam failure.

3) Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: SIGNED
Chief, Engineering Division
21 FEB 1979
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer
21 FEB 1979
Date

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Robert Schulte Dam
State Located	Missouri
County Located	St. Charles County
Stream	Unnamed Tributary of Peruque Creek
Date of Inspection	29 November 1978 and 27, 28 November 1978

Robert Schulte Dam was inspected by an interdisciplinary team of engineers from Reitz & Jens, Inc. under contract with the St. Louis District Corps of Engineers. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations and private engineers. Based on these guidelines, this dam is classified as a small dam with a high downstream hazard potential. The estimated damage zone from failure of the dam extends two miles downstream from the dam.

Failure would threaten the life and property of four families and cause appreciable damage to one county road.

Our inspection and evaluation indicates that the dam is deficient in that the spillways do not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Considering the small volume of water impounded, the large floodplain downstream and the four groups of farm buildings downstream, one-half Probable Maximum Flood (PMF) is the appropriate spillway design flood. The probable maximum flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions reasonably possible in the region. The dam will begin to be overtopped by a flood having a discharge (peak and volume) equal to 10% of the PMF. The spillways will not pass a 1% chance flood (100-year flood) without overtopping the dam which is a flood that has a 1% chance of being exceeded in any given year.

Other deficiencies observed by the inspection team were lack of erosion protection both for the emergency spillway and the upstream face of the dam.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available which is considered a deficiency.

The inadequate spillways capacities are a serious safety deficiency which will be aggravated as land use in the watershed changes from agricultural to suburban development.

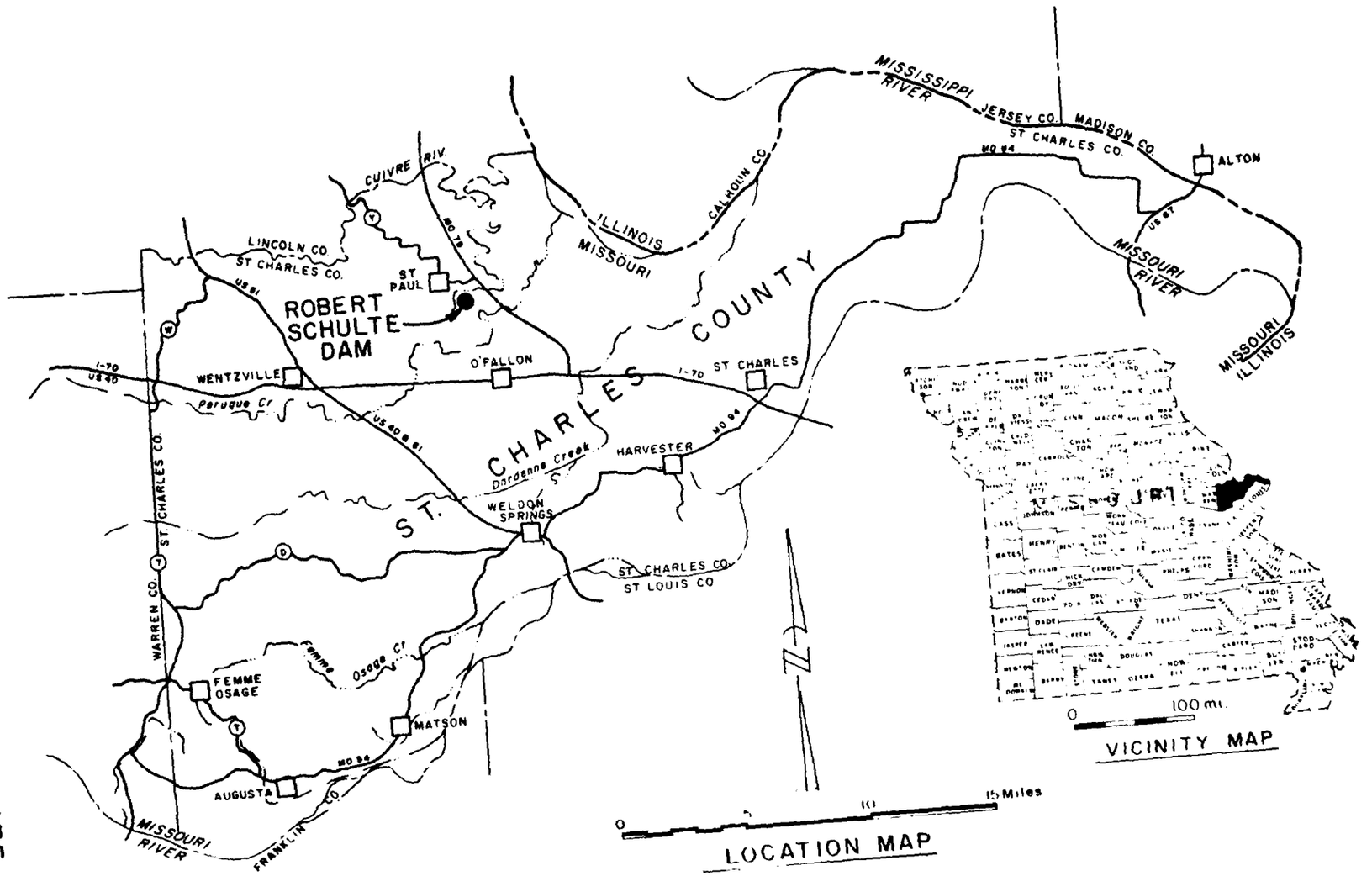
We recommend the owner take prompt action to correct or control the deficiencies described.

HENRY M. REITZ, President
Reitz & Jens, Inc.

JOHN J. BAILEY, JR., Vice President
Chief Engineer, Reitz & Jens, Inc.

OVERVIEW – 10497

PLATE 1


MISSISSIPPI RIVER
JERSEY CO.
MADISON CO.
ST CHARLES CO.
ALTON
MO 94
US 67
CULVRE RIV.
MO 79
ILLINOIS
CALHOLIN CO.
MISSOURI
LINCOLN CO.
ST CHARLES CO.
ST PAUL
US 61
ROBERT SCHULTE DAM
ST CHARLES COUNTY
MISSOURI RIVER
MISSOURI ILLINOIS
I-70
US 40
WENTZVILLE
O'FALLON
I-70
ST CHARLES
Peruque Cr
US 40 & 61
HARVESTER
MO 94
Dardenne Creek
ST. CHARLES
WELDON SPRINGS
ST CHARLES CO.
ST LOUIS CO
WARREN CO.
ST CHARLES CO.
Femme Osage Cr
FEMME OSAGE
MATSON
MO 94
AUGUSTA
MISSOURI RIVER
FRANKLIN CO.
0
5
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15 Miles
LOCATION MAP
0
100 mi.
VICINITY MAP

PLATE 2

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
Robert Schulte Dam, MO ID NO. 10497

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LIST OF INDICES AND PHOTOGRAPH NUMBERS

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer contracted with Reitz & Jens, Inc. (Contract DACW43-78-C-0162) for a safety inspection of the Robert Schulte Dam Mo. ID No. 10497

b. Purpose of Inspection The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances The earth dam is built in a draw in rolling upland topography. Soils are formed in loess deposits over glacial till covering the Keokuk Limestone. It has an emergency spillway path which starts as a shallow cut section in the soil mantle at the east end of the dam embankment and then flow would be generally along the contact between the toe of the dam embankment and the natural topography. The Weldon Silt Loam and silty clay loam comprise 80% of the soils in the watershed. These soils occur on the steeper 2% to 11% slopes and are considered to be Hydrologic Soil Group "D".

Land use in the watershed is about 3% lake, 13% pasture, 77% cultivated and 6% subdivided for residential use.

In the fairly near future it would appear that the percent pasture may be reduced to 8% and the percent subdivided may increase to 12% as land development for residential purposes continues.

About one-half the cultivated area is terraced and contour-plowed; the other half is plowed in rows. There are 8 small impoundments, 5 of which are less than ¼-acre in size; two are between ¼- and ½-acre; and one is between ½- and 1.0 acre. It is estimated the total surface area of these is less than 2-½ acres.

About 15% of the watershed, mainly in the uppermost reaches, drains through these ponds. It is estimated that these soils are in Hydrologic Soil Group "C" with a slight bias toward "D".

Topography in the vicinity of the dam is shown on Plate 3

Pertinent physical data are given in paragraph 1.3 below.

b. Location The dam is located in the northeastern part of St. Charles County about 4-1/2 miles northwest of O'Fallon, as shown on Plate 2. The dam and lake are located in the SW¼ of the NW¼ of Section 7, T47N, R3E, and are not shown on the St. Charles County, Missouri-O'Fallon Quadrangle Sheet, 1968 Edition.

c. Size Classification Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1.c above. Based on these criteria, this dam and impoundment is in the small size category.

d. Hazard Classification Guidelines for determining hazard classification are presented in the same guidelines referenced in paragraph c above. Based on referenced guidelines, this dam is in the High Hazard Classification.

e. Ownership The dam is owned by Mr. Ervin Davis,

f. Purpose of Dam The dam forms a 5.9-acre recreational lake.

g. Design and Construction History The inspection team was unable to find any design data on this dam. The Soil Conservation Service, USDA, supplied records of a dam built by Robert Schulte in Section 7 but these were found to pertain to another structure a mile away. The inspection team was told that the dam was constructed in 1972 or 1973 by Glosier Construction Company.

h. Normal Operating Procedure Normal rainfall, runoff, transpiration, and evaporation all combine to maintain a relatively stable water surface elevation. The maximum water depth ever experienced at the spillway is unknown.

1.3 PERTINENT DATA

a. Drainage Area - 333 acres

b. Discharge at Damsite -

(1) All discharge at the damsite is through uncontrolled spillways.

(2) Estimated experienced maximum flood at damsite - unknown.

(3) Estimated ungated spillway capacity at maximum pool elevation -

(a) Principal pipe spillway - 8 cfs

(b) Emergency spillway - 110 cfs

(c) Total - 118 cfs

c. Elevation (Feet Above M.S.L.)

(1) Top of dam - 493.6 to 494.5 (see Plate 3).

(2) Spillway crest (1) flowline 16-inch pipe - 488.4
(2) flowline emergency spillway - 492.0

(3) Streambed at centerline of dam - 470.0± (estimated).

(4) Maximum tailwater - unknown.

d. Reservoir Length of maximum pool - 1300 feet ± (estimated from aerial photos).

e. Storage

(1) Top of dam - 77 acre feet.

(2) Flowline principal (pipe) spillway - 36 acre feet

f. Reservoir Surface

(1) Top of dam - 10.6 acres (estimated from USGS Map).

(2) Principal spillway flowline - 5.90 acres (from aerial photo).

(3) Emergency spillway crest - 9.2 acres (estimated from USGS Map).

g. Dam

(1) Type - earth embankment

(2) Length - 350 feet

(3) Height - 24.5 feet maximum (from survey).

(4) Top width - 8 to 10 feet

(5) Side Slopes -

(a) Downstream - 1V on 3H (determined from section at Station 3+00, see Plate 3).

(b) Upstream - 1V on 4H (from visual observations).

(6) Zoning - unknown

(7) Impervious core - See Paragraphs 2.2 and 3.1.b

(8) Cutoff - uncertain - see paragraphs 2.2 and 3.1.b

(9) Grout curtain - unknown

h. Diversion and Regulating Tunnel - None

i. Spillways -

(1) Principal spillway: smooth steel 16-inch diameter pipe through dam at 15% grade with hood and wire trash rack at upper end.

(2) Emergency spillway: Unlined V-shaped earth channel 1-1/2 feet deep below dam crest and 25 feet wide, excavated in virgin soil at east end of dam.

j. Regulating Outlets - None

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were found to be readily available (see paragraph 1.2.g). It appears from the spillway configuration (i.e. a drawdown pipe and emergency spillway) that some design advice was given by the Soil Conservation Service USDA.

2.2 CONSTRUCTION

The dam was constructed in 1973. Mr. Clem Weber, who worked for the contractor, told a member of the inspection team that an inspection trench about 20 feet deep was cut to the underlying clay and the inspection (cutoff) trench and the embankment was rolled with a sheepsfoot roller. He said one antiseep collar was placed on the 16-inch pipe spillway.

2.3 OPERATION

The maximum loading on the dam is unknown. The lake level seems to remain stable during average precipitation of 38 inches per year. There are no records of operation of the dam.

It appears from the condition of the emergency spillway that it has carried little or no flow since completion.

2.4 EVALUATION

a. Availability No engineering data were available.

b. Adequacy No engineering data were available. The owner should have an engineer, experienced in the design of dams, perform detailed seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams".

However, for the size of dam, materials used and measurements taken, a satisfactory hydrologic/hydraulic evaluation resulted. Also, for the section and the presence of the primary spillway plus the visual inspection of a dam with reservoir of at least five years of age, the general condition of the dam, when considered by the experienced engineers, indicated that even though a detailed assessment of the design and construction in an analytical sense was not possible, a defensible evaluation of the dam as a structure was feasible.

c. Validity This report is primarily for safety through maintenance and operation and the conclusions and evaluation for this Phase I Inspection are considered adequate for the definitive statement in this report.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General A visual inspection of Robert Schulte Dam was made on 30 November 1978. The actual owner of the property with this dam is Ervin Davis; the name assigned this dam in some government records is Robert Schulte Dam. This inspection followed field measurements by a survey party on 27 and 28 November 1978. The training and experience of personnel in these inspections included hydrologic/hydraulic engineering, soils and materials engineering, surveying and structural engineering.

b. Dam The dam was built in the 1972-1973 period by Glosier Construction Co. It is an earth dam with top width of 10 feet (Photo D-4). Top has been used as a road and with the very gradual slopes on the sides of the relatively shallow and broad emergency spillway area at the east end of the dam, trucks and farm equipment can be driven onto and across the dam with ease. The average height of the dam is about 20 feet with a maximum of about 25 feet. The downstream slope is 1V on 3H (D-1) with the upstream slope down to the water surface about 1V on 4H (D-3, D-4). The dam crest is nearly level. Both downstream and upstream slopes have grass cover. There is no armor protection on the reservoir face of the dam and erosion from wave-wash and localized sloughing has developed despite the flat upstream slope of the dam (D-3, D-5, D-6, D-7). The lake was at its "normal pool" level as controlled by the principal spillway. Freeboard to the top of the dam from the flowline of the principal spillway is about 5 feet and above the emergency spillway control elevation about two feet.

The owner described the excavation of a trench prior to building the earth embankment which he reports extended to a clay (impermeable) stratum and had a maximum depth of about 20 feet. This is considered to be an "inspection trench" during its excavation which when the fill of the embankment is then placed becomes homogeneous and less permeable and a cutoff trench against stratification or paths with higher permeabilities that could lead to piping problems. Visual inspection of the top and slopes of the dam did not find physical evidence of slides (cracks without or with offsets), seepage or burrowing or digging of animals. This type determination is reliable because the ground surfaces involved were bare or only had turf cover. The sloughing at the water's edge is discussed and results from absence of erosion protection on the lake shore.

c. Spillways The primary spillway is an inclined steel pipe with screen trash rack to prevent clogging by floating debris. Incidentally, the screening, through induced frictional resistance, reduces the tendency toward formation of a vortex (S-3, S-4). The pipe spillway has a constant gradient through the dam and discharges into the natural channel downstream (S-1, S-2). There has been some scour below the discharge end. The scour hole is a sufficient distance from the toe of dam and the steel pipe has sufficient cantilever strength to prevent an erosive regression into the dam section that could lead to failure by increased piping gradient, either along the outside of the primary spillway pipe or through the dam section. The owner reports that one steel diaphragm type anti-seepage collar was put around this pipe.

The emergency spillway for the dam is a broad, shallow swale at the east end (S-5, S-6, S-8); its capacity is relatively small. Visually, there appears to be an indication of a spillway on the west end (S-7); however, grades from surveys (See Plate 3) show it too high to be a spillway.

The emergency spillway alignment is at the contact between the fill in the dam and virgin soil. The soils in this part of St. Charles County are of eolian (windblown) origin which characteristically have low plasticities and high erodibility. There are no clear signs of erosion in the emergency spillway. This is considered to be the result of very little if any need for the capacity of the emergency spillway since the lake has been filled from the fortunate absence of precipitation events which could cause high magnitudes of surface runoff and also, the good land management practices currently going on in the watershed.

d. Reservoir The land use in the watershed of this dam is a mixture of low density residential and agricultural (P-1, P-2, P-3). The trend for land use in this area is increasing urbanization, thereby effectively increasing residential density and relative amounts of impermeable surfaces. Presently, the land management techniques to reduce peak rates of overland flow and storm runoff appear better than typical of the metropolitan area. However, even with very gentle slopes of the terrain above the lake in all directions, the eolian origin of the soil which is indicative of relatively easy erodibility, has resulted in sloughing of the bankline (P-4). Because the area is intensively farmed, either in crop or pasture, few tree masses presently exist. This, combined with the relative flatness of the terrain, results in fairly high wind velocities across the lake surface and probably contributes to bank erosion.

e. Downstream Channel The channel below the dam crosses a county road approximately one-fourth mile to the north. It then joins the valley of a larger watershed and runs eastwardly about a mile to two road crossings the first an old state highway alignment now used as a local service road; the second, Missouri 79 at the edge of the alluvial plain of the Mississippi River. The presently existing land use in the valley downstream is agricultural.

3.2 EVALUATION

None of the conditions observed is significant enough to indicate need for immediate remedial action. The details of the actual dam construction, inspection trench as described, steel primary pipe on the primary spillway with even one anti-seepage collar and flat sections, are positive factors favorable to this development. The maintenance of the grass cover on the dam slopes is necessary considering the gentle slopes and can be easily done with mechanical equipment.

Additional capacity in the emergency spillway is necessary and provisions to prevent serious erosive deepening when flows go through it, are necessary.

The upstream slope of the dam needs protection against wave-wash and other factors contributing to erosion. The shoreline away from the dam may continue to slough locally which does not endanger the dam.

The potential for failure of this dam will continue to increase as the watershed above the dam experiences urbanization unless remedial measures recommended in Section 7 are implemented.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no controlled outlet works for this dam; therefore, no regulating procedures exist. The pool is controlled by rainfall, runoff, evaporation and capacity of the uncontrolled spillways.

4.2 MAINTENANCE OF DAM

The dam appears to have been mowed at sufficiently close intervals to maintain a good turf cover. No trees or brush are growing on the dam. The principal spillway pipe and trash rack have been kept in good condition.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities exist at this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

The inspection team is not aware of any existing warning system for this dam.

4.5 EVALUATION

Maintenance of the dam to date has been more than adequate. Continued attention should be given to mowing the slopes and keeping the trash rack clear of debris.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data No design data were found to be readily available.

b. Experience Data The drainage area is 324 acres, developed from USGS O'Fallon Missouri Quadrangle. Also available are 1" 2000' aerial stereo pairs taken 22 March 1977, by Surdex Corporation. Lake area is measured on a 1"=200' enlargement of a portion of one of these photographs and shown on Plate 1. The spillway and dam layout are from surveys made during the inspection. Plate 3 shows the pertinent grades and numerical conversion to MSL USGS datum.

c. Visual Observations

(1) The 16-inch diameter smooth steel principal spillway pipe and trash rack are in good condition. Upper end of pipe is cut at an angle for anti-vortex purposes.

(2) The emergency spillway and exit channel are located at the east end of the dam.

(3) No drawdown facilities are available to evacuate the pool.

(4) Maximum emergency spillway releases may erode and degrade the spillway channel and endanger the integrity of the dam

d. Overtopping Potential The spillways are too small to pass the minimum required flood of one-half the probable maximum without overtopping. The probable maximum flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions reasonably possible in the region. The capacity of the combined spillway is seriously inadequate. The dam will start to be overtopped by a flood equal to 8% of the PMF. The one-half PMF will overtop the dam to a maximum depth of about 1.9 feet. The entire width of dam crest will be subject to some overtopping flow. Maximum rate of flow over the dam crest will be about 1,810 cubic feet per second. Overtopping flow will have a duration of 9 hours. The existing lake and spillways are not adequate to pass a 100-year frequency flood. The 100-yead flood will overtop the dam to a maximum depth of 1.1 feet. See Appendix A

Failure of the eight upstream water impoundments shown on the USGS sheet or described in paragraph 1.2 would not have a significant impact on the hydrologic or hydraulic analysis.

The effect from rupture of the dam could extend approximately two miles downstream of the dam. There are four inhabited homes downstream of the dam which could be severely damaged and lives of the inhabitants could be lost should failure of the dam occur.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations Visual observations which affect the structural stability of this dam are discussed in Section 3, paragraph 3.1.b.

b. Design and Construction Data No design or construction data relating to the structural stability of the dam were found.

c. Operating Records No appurtenant structures requiring operation exist at this dam.

d. Post Construction Changes No post construction changes exist which will affect the structural stability of the dam.

e. Seismic Stability Considering the seismic zone (2) in which this dam is located, an earthquake of this magnitude is not expected to cause a structural failure of this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety The spillway is inadequate to pass the required one-half Probable Maximum Flood (PMF).

Considering the small volume of water impounded, the large floodplain downstream and the four groups of farm buildings downsteam, one-half the PMF is the appropriate spillway design flood .

The reservoir and spillways are inadequate to contain a flood which has a 1% chance of being exceeded (100-year flood) in any given year. Current land management practices in this watershed tend to reduce peak and volume of ordinary runoff events. These have little or no effect on extreme events. The hydrologic analysis recognized the potential for future urbanization.

Several items were noted during the visual inspection by the inspection team which should be corrected or controlled. An armor-coat to protect the reservoir slope of the dam against wave-wash is needed. Erosion protection for the emergency spillway is deficient.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available which is considered a deficiency.

b. Adequacy of Information Due to lack of engineering design and construction data, the conclusions in this report were based on performance history and external visual conditions. The inspection team considers these data sufficient to support the conclusions herein.

c. Urgency The remedial measures recommended in paragraph 7.2 should be accomplished in the near future. If the safety deficiencies listed in paragraph a are not corrected in the near future, they will continue to deteriorate and lead to a serious potential of failure.

d. Necessity for Phase II Based on the results of the Phase I Inspection, no Phase II Inspection is recommended.

e. Seismic Stability This dam is located in Seismic Zone 2. An earthquake of this magnitude is not expected to be hazardous to this dam.

7.2 REMEDIAL MEASURES

a. Recommendations The owner should obtain the services of an engineer experienced in the design and construction of dams to design and observe construction of the following remedial measures:

(1) Emergency spillway size and/or height of dam should be increased to pass the one-half probable maximum flood without overtopping the dam.

(2) As part of (1) above, an erosion resistant sill or lining should be provided for the emergency spillway and its outlet channel to the valley below.

(3) Provide an armor-coat to protect the reservoir face of the dam against wave-wash and sloughing.

b. Stability and Seepage Analyses The owner should have an engineer experienced in the design and construction of dams prepare seepage and stability analyses.

c. O&M Maintenance and Procedures The following O&M maintenance and procedures are recommended:

(1) Continue present methods of control of growth of vegetation on the dam.

(2) Periodically, check the condition of the 16-inch steel pipe through the dam for evidence of corrosion and leakage. Water leaking into or out of a corroded principal spillway pipe could cause piping failure of the embankment.

(3) Maintain the trash rack at the inlet of the principal spillway. Periodically, remove accumulations of trash which, if left in place, could eventually greatly reduce the capacity of the pipe.

(4) Maintain an erosive-resistant sill in the control section of the spillway and an armor-coat on the upstream face of the dam.

(5) After completion of the remedial measures, detailed inspections of the dam should be made periodically by an engineer experienced in design and construction of dams. Records should be kept of thes inspections and major maintenance.

APPENDIX A

HYDROLOGIC CALCULATIONS

HYDROLOGIC AND HYDRAULIC ANALYSIS METHODOLOGY

1. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for a reservoir routing. The Probable Maximum Precipitation for those dams in the high hazard potential category is derived and determined from regional charts prepared by the National Weather Service in "Hydrometeorological Report No. 33". Reduction factors have not been applied. A 24-hour storm duration is assumed with the 24-hour rainfall depths distributed over 6-hour periods in accordance with procedures outlined in EM 1110-2-1411 (SPF Determination). The maximum 6-hour rainfall period is then distributed to hourly increments by the same criteria. Within-the-hour distribution is based upon NOAA Technical Memorandum NWS HYDRO-35. The non-peak 6-hour rainfall periods are distributed uniformly. All distributed values are arranged in a critical sequence by the SPF criteria. The final inflow hydrograph is produced by deduction of infiltration losses appropriate to the soil, land use and antecedent moisture conditions.

2. The reservoir routing is accomplished by using Modified Puls routing techniques wherein the flood hydrograph is routed through lake storage. Hydraulic capacities of the spillways and crest of dam are used as outlet controls in the routing. Storage in the pool area is defined by an elevation-area curve. The hydraulic capacity of the spillways and the crest of dam is defined by a composite elevation discharge curve.

3. Dam overtopping analysis has been conducted by hydrologic methods for this dam and lake. This computation determined the percentage of the PMF hydrograph that the reservoir can contain without the dam being overtopped. An output summary in the hydrologic appendix displays this information as well as other characteristics of the simulated dam overtopping.

4. The above methodology has been accomplished for this report using the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. The numeric parameters estimated for this site are listed on Plate 1A. Definitions of these variables are contained in the "User's Manual" for the computer program.

5. Capacity of the 16-inch principal spillway pipe was calculated using Chart 5 of Hydraulic Engineering Circular No. 5 of the Federal Highway Administration 1974 reprint. The projecting pipe condition (3) with inlet control was used. Friction on the 15% pipe grade did not control at any lake level.

6. The discharge in the emergency spillways was calculated using critical depth at the control section where the dam centerline crosses the spillway channel, allowing 0.2 velocity head for non-uniform velocity distribution, velocity transition losses and friction in the short approach channel. This is equivalent to calculating the spillway as a broad-crested weir with a discharge coefficient of 2.80.

7. Flow over the top of dam was calculated using a level crest and a discharge coefficient of 3.0 in the broad-crested weir equation. A correction was made for the short, lower section of the dam where overtopping flow starts. All spillway and overtopping discharge was included in a composite rating curve. Dummy values of 0.1 for dam length, coefficient of discharge and exponent were entered on the $D card to suppress diagnostic statements in the output. The amount of this dummy flow is never greater than 0.02 cfs.

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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  3 AUG 78
**********************************
    1                 A  ********** ID #10497 ROBERT SCHULTE ** ADD 390 FOR USGS ELEV ******
    2                 A  ********** DAM SAFETY PROGRAM - U. S. CORPS OF ENGINEERS **********
    3                 A  ********** REITZ & JENS, INC. -    AUGUST 1978 **********************
    4                 B    288        0        5       -0       -0       -0       -0       -0       -4       -0
    5                 I      5
    6                 J      1        9        1
    7                 J1  0.04     0.05     0.06     0.07     0.08     0.10     0.20     0.50     1.00
    8                 K      0        1                          1        3        1
    9                 1  ***** INFLOW HYDROGRAPH - SCS METHOD *****
   10                 M      1        2    0.520                          1                          1
   11                 P              24.9      101      120      130
   12                 T                                                          -1      -92                0.04
   13                 W2             0.45
   14                 X             -0.20      2.0
   15                 K      1        1                          1                1
   16                 1  ***** RESERVOIR ROUTING - RATING CURVE SUPPLIED - LEVEL DAM *******
   17                 Y                                    1        1
   18                 Y1     1                                                  -99.0       -1
   19                 Y4  98.42    98.62    99.00    99.22    100.0    101.0    102.0    102.3    102.5    102.7
   20                 Y4  103.0    103.6    104.0    104.2    104.5    104.7    105.0    105.5    106.0    107.0
   21                 Y5    0.0      0.1      0.8      1.8      3.8      5.5      6.6     9.95     14.1     20.3
   22                 Y5   39.5    118.0    218.0    288.0    484.0    714.0   1089.0   1879.0   2849.0   5240.0
   23                 $A   0.00     5.90     16.5     33.1
   24                 $E   80.0     98.4    110.0    120.0
   25                 $$ 98.42
   26                 $D 103.6      0.1      0.1      0.1
   27                 K     99
```

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  3 AUG 78
**********

RUN  DATED 12/20/78.
     TIME0 08.36.12.

* ********** ID #10497 ROBERT SCHULTE ** ADD 390 FOR USGS ELEV ******
 ********** DAM SAFETY PROGRAM - U. S. CORPS OF ENGINEERS **********
 ********** RFITZ & JENS, INC. -    AUGUST 1978 **********

                    JOB SPECIFICATION
 NQ      NHR     NMIN     IDAY     IHR     IMIN    METRC     IPLT     IPRT    NSTAN
288        0        5       -0      -0       -0       -0       -0       -4       -0
                          JOPER      NWT   LROPT    TRACE
                              5       -0      -0       -0

                MULTI-PLAN ANALYSES TO BE PERFORMED
                    NPLAN= 1 NRTIO= 9 LRTIO= 1
   RTIOS=     .04     .05     .06     .07     .08     .10     .20     .50    1.00

**********      **********      **********      **********      **********

                SUB-AREA RUNOFF COMPUTATION

***** INFLOW HYDROGRAPH - SCS METHOD *****
              ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                  1       0      -0      -0       1       3       1      -0      -0

                    HYDROGRAPH DATA
    IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
        1       2     .52   -0.00     .52    1.00  -0.000      -0       1      -0

                    PRECIP DATA
          SPFE     PMS      R6     R12     R24     R48     R72     R96
         -0.00   24.90  101.00  120.00  130.00   -0.00   -0.00   -0.00

                    LOSS DATA
 LROPT   STRKR   DLTKR   RTIOL   FRAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
    -0   -0.00   -0.00    1.00   -0.00   -0.00    1.00   -1.00  -92.00   -0.00     .04

  CURVE NO =  -92.00  WETNESS =   -1.00  EFFECT CN =   92.00

                UNIT HYDROGRAPH DATA
              TC= -0.00    LAG=   .45

                RECESSION DATA
              STRTQ=   -0.00    QRCSN=   -.20    RTIOR= 2.00

  UNIT HYDROGRAPH 29 END OF PERIOD ORDINATES, TC=   -0.00 HOURS, LAG=    .45  VOL= 1.00
    40.     121.     249.     401.     490.     510.     480.     417.     332.     238.
   180.     137.     105.      79.      61.      46.      35.      26.      20.      15.
    12.       9.       7.       5.       4.       3.       2.       1.       0.

                END-OF-PERIOD FLOW
     0
 MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q
```

PLATE A-1
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Q MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	.00	.01	0.	1.01	12.05	145	.21	.21	.00	265.
1.01	.10	2	.01	.00	.01	0.	1.01	12.10	146	.21	.21	.00	282.
1.01	.15	3	.01	.00	.01	0.	1.01	12.15	147	.21	.21	.00	317.
1.01	.20	4	.01	.00	.01	0.	1.01	12.20	148	.21	.21	.00	374.
1.01	.25	5	.01	.00	.01	1.	1.01	12.25	149	.21	.21	.00	444.
1.01	.30	6	.01	.00	.01	1.	1.01	12.30	150	.21	.21	.00	516.
1.01	.35	7	.01	.00	.01	1.	1.01	12.35	151	.21	.21	.00	585.
1.01	.40	8	.01	.00	.01	1.	1.01	12.40	152	.21	.21	.00	644.
1.01	.45	9	.01	.00	.01	2.	1.01	12.45	153	.21	.21	.00	692.
1.01	.50	10	.01	.00	.01	2.	1.01	12.50	154	.21	.21	.00	726.
1.01	.55	11	.01	.00	.01	2.	1.01	12.55	155	.21	.21	.00	752.
1.01	1.00	12	.01	.00	.01	2.	1.01	13.00	156	.21	.21	.00	772.
1.01	1.05	13	.01	.00	.01	2.	1.01	13.05	157	.25	.25	.00	789.
1.01	1.10	14	.01	.00	.01	2.	1.01	13.10	158	.25	.25	.00	805.
1.01	1.15	15	.01	.00	.01	2.	1.01	13.15	159	.25	.25	.00	825.
1.01	1.20	16	.01	.00	.01	2.	1.01	13.20	160	.25	.25	.00	848.
1.01	1.25	17	.01	.00	.01	3.	1.01	13.25	161	.25	.25	.00	874.
1.01	1.30	18	.01	.00	.01	3.	1.01	13.30	162	.25	.25	.00	899.
1.01	1.35	19	.01	.00	.01	4.	1.01	13.35	163	.25	.25	.00	923.
1.01	1.40	20	.01	.00	.01	5.	1.01	13.40	164	.25	.25	.00	943.
1.01	1.45	21	.01	.00	.01	6.	1.01	13.45	165	.25	.25	.00	958.
1.01	1.50	22	.01	.00	.01	7.	1.01	13.50	166	.25	.25	.00	970.
1.01	1.55	23	.01	.00	.01	8.	1.01	13.55	167	.25	.25	.00	979.
1.01	2.00	24	.01	.00	.01	9.	1.01	14.00	168	.25	.25	.00	985.
1.01	2.05	25	.01	.00	.01	10.	1.01	14.05	169	.31	.31	.00	993.
1.01	2.10	26	.01	.00	.01	12.	1.01	14.10	170	.31	.31	.00	1005.
1.01	2.15	27	.01	.00	.01	13.	1.01	14.15	171	.31	.31	.00	1024.
1.01	2.20	28	.01	.01	.01	14.	1.01	14.20	172	.31	.31	.00	1051.
1.01	2.25	29	.01	.01	.01	15.	1.01	14.25	173	.31	.31	.00	1084.
1.01	2.30	30	.01	.01	.01	16.	1.01	14.30	174	.31	.31	.00	1117.
1.01	2.35	31	.01	.01	.01	17.	1.01	14.35	175	.31	.31	.00	1148.
1.01	2.40	32	.01	.01	.01	18.	1.01	14.40	176	.31	.31	.00	1175.
1.01	2.45	33	.01	.01	.01	19.	1.01	14.45	177	.31	.31	.00	1196.
1.01	2.50	34	.01	.01	.01	20.	1.01	14.50	178	.31	.31	.00	1212.
1.01	2.55	35	.01	.01	.01	21.	1.01	14.55	179	.31	.31	.00	1224.
1.01	3.00	36	.01	.01	.01	22.	1.01	15.00	180	.31	.31	.00	1233.
1.01	3.05	37	.01	.01	.01	23.	1.01	15.05	181	.19	.19	.00	1235.
1.01	3.10	38	.01	.01	.01	23.	1.01	15.10	182	.38	.38	.00	1233.
1.01	3.15	39	.01	.01	.01	24.	1.01	15.15	183	.38	.38	.00	1229.
1.01	3.20	40	.01	.01	.01	25.	1.01	15.20	184	.57	.57	.00	1238.
1.01	3.25	41	.01	.01	.01	26.	1.01	15.25	185	.67	.67	.00	1284.
1.01	3.30	42	.01	.01	.01	26.	1.01	15.30	186	1.62	1.62	.00	1414.
1.01	3.35	43	.01	.01	.01	27.	1.01	15.35	187	2.68	2.67	.00	1711.
1.01	3.40	44	.01	.01	.01	28.	1.01	15.40	188	1.05	1.05	.00	2183.
1.01	3.45	45	.01	.01	.01	28.	1.01	15.45	189	.67	.67	.00	2799.
1.01	3.50	46	.01	.01	.01	29.	1.01	15.50	190	.57	.57	.00	3409.
1.01	3.55	47	.01	.01	.01	30.	1.01	15.55	191	.38	.38	.00	3795.
1.01	4.00	48	.01	.01	.01	30.	1.01	16.00	192	.38	.38	.00	3915.
1.01	4.05	49	.01	.01	.01	31.	1.01	16.05	193	.29	.29	.00	3803.
1.01	4.10	50	.01	.01	.01	31.	1.01	16.10	194	.29	.29	.00	3518.
1.01	4.15	51	.01	.01	.01	32.	1.01	16.15	195	.29	.29	.00	3121.
1.01	4.20	52	.01	.01	.01	32.	1.01	16.20	196	.29	.29	.00	2705.
1.01	4.25	53	.01	.01	.00	33.	1.01	16.25	197	.29	.29	.00	2367.
1.01	4.30	54	.01	.01	.00	33.	1.01	16.30	198	.29	.29	.00	2095.
1.01	4.35	55	.01	.01	.00	34.	1.01	16.35	199	.29	.29	.00	1879.
1.01	4.40	56	.01	.01	.00	34.	1.01	16.40	200	.29	.29	.00	1711.
1.01	4.45	57	.01	.01	.00	35.	1.01	16.45	201	.29	.29	.00	1583.
1.01	4.50	58	.01	.01	.00	35.	1.01	16.50	202	.29	.29	.00	1486.
1.01	4.55	59	.01	.01	.00	35.	1.01	16.55	203	.29	.29	.00	1412.
1.01	5.00	60	.01	.01	.00	36.	1.01	17.00	204	.29	.29	.00	1355.

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1.01	5.05	61	.01	.01	.00	36.	1.01	17.05	205	.23	.23	.00	1310.
1.01	5.10	62	.01	.01	.00	36.	1.01	17.10	206	.23	.23	.00	1271.
1.01	5.15	63	.01	.01	.00	37.	1.01	17.15	207	.23	.23	.00	1231.
1.01	5.20	64	.01	.01	.00	37.	1.01	17.20	208	.23	.23	.00	1187.
1.01	5.25	65	.01	.01	.00	38.	1.01	17.25	209	.23	.23	.00	1143.
1.01	5.30	66	.01	.01	.00	38.	1.01	17.30	210	.23	.23	.00	1101.
1.01	5.35	67	.01	.01	.00	38.	1.01	17.35	211	.23	.23	.00	1062.
1.01	5.40	68	.01	.01	.00	39.	1.01	17.40	212	.23	.23	.00	1029.
1.01	5.45	69	.01	.01	.00	39.	1.01	17.45	213	.23	.23	.00	1003.
1.01	5.50	70	.01	.01	.00	39.	1.01	17.50	214	.23	.23	.00	983.
1.01	5.55	71	.01	.01	.00	39.	1.01	17.55	215	.23	.23	.00	967.
1.01	6.00	72	.01	.01	.00	40.	1.01	18.00	216	.23	.23	.00	956.
1.01	6.05	73	.07	.05	.02	42.	1.01	18.05	217	.02	.02	.00	940.
1.01	6.10	74	.07	.05	.01	47.	1.01	18.10	218	.02	.02	.00	909.
1.01	6.15	75	.07	.05	.01	57.	1.01	18.15	219	.02	.02	.00	853.
1.01	6.20	76	.07	.05	.01	73.	1.01	18.20	220	.02	.02	.00	773.
1.01	6.25	77	.07	.05	.01	94.	1.01	18.25	221	.02	.02	.00	721.
1.01	6.30	78	.07	.05	.01	115.	1.01	18.30	222	.02	.02	.00	673.
1.01	6.35	79	.07	.06	.01	136.	1.01	18.35	223	.02	.02	.00	628.
1.01	6.40	80	.07	.06	.01	155.	1.01	18.40	224	.02	.02	.00	586.
1.01	6.45	81	.07	.06	.01	170.	1.01	18.45	225	.02	.02	.00	546.
1.01	6.50	82	.07	.06	.01	182.	1.01	18.50	226	.02	.02	.00	510.
1.01	6.55	83	.07	.06	.01	192.	1.01	18.55	227	.02	.02	.00	476.
1.01	7.00	84	.07	.06	.01	200.	1.01	19.00	228	.02	.02	.00	444.
1.01	7.05	85	.07	.06	.01	207.	1.01	19.05	229	.02	.02	.00	414.
1.01	7.10	86	.07	.06	.01	212.	1.01	19.10	230	.02	.02	.00	386.
1.01	7.15	87	.07	.06	.01	217.	1.01	19.15	231	.02	.02	.00	360.
1.01	7.20	88	.07	.06	.01	221.	1.01	19.20	232	.02	.02	.00	336.
1.01	7.25	89	.07	.06	.01	224.	1.01	19.25	233	.02	.02	.00	314.
1.01	7.30	90	.07	.06	.01	227.	1.01	19.30	234	.02	.02	.00	293.
1.01	7.35	91	.07	.06	.01	230.	1.01	19.35	235	.02	.02	.00	273.
1.01	7.40	92	.07	.06	.01	232.	1.01	19.40	236	.02	.02	.00	255.
1.01	7.45	93	.07	.06	.01	234.	1.01	19.45	237	.02	.02	.00	238.
1.01	7.50	94	.07	.06	.00	236.	1.01	19.50	238	.02	.02	.00	222.
1.01	7.55	95	.07	.06	.00	237.	1.01	19.55	239	.02	.02	.00	207.
1.01	8.00	96	.07	.06	.00	239.	1.01	20.00	240	.02	.02	.00	193.
1.01	8.05	97	.07	.06	.00	240.	1.01	20.05	241	.02	.02	.00	180.
1.01	8.10	98	.07	.06	.00	241.	1.01	20.10	242	.02	.02	.00	168.
1.01	8.15	99	.07	.06	.00	242.	1.01	20.15	243	.02	.02	.00	157.
1.01	8.20	100	.07	.06	.00	243.	1.01	20.20	244	.02	.02	.00	146.
1.01	8.25	101	.07	.06	.00	244.	1.01	20.25	245	.02	.02	.00	137.
1.01	8.30	102	.07	.06	.00	245.	1.01	20.30	246	.02	.02	.00	127.
1.01	8.35	103	.07	.06	.00	246.	1.01	20.35	247	.02	.02	.00	119.
1.01	8.40	104	.07	.06	.00	247.	1.01	20.40	248	.02	.02	.00	111.
1.01	8.45	105	.07	.06	.00	247.	1.01	20.45	249	.02	.02	.00	104.
1.01	8.50	106	.07	.06	.00	248.	1.01	20.50	250	.02	.02	.00	97.
1.01	8.55	107	.07	.06	.00	249.	1.01	20.55	251	.02	.02	.00	90.
1.01	9.00	108	.07	.06	.00	249.	1.01	21.00	252	.02	.02	.00	84.
1.01	9.05	109	.07	.06	.00	250.	1.01	21.05	253	.02	.02	.00	83.
1.01	9.10	110	.07	.06	.00	250.	1.01	21.10	254	.02	.02	.00	83.
1.01	9.15	111	.07	.06	.00	251.	1.01	21.15	255	.02	.02	.00	83.
1.01	9.20	112	.07	.06	.00	251.	1.01	21.20	256	.02	.02	.00	83.
1.01	9.25	113	.07	.06	.00	252.	1.01	21.25	257	.02	.02	.00	83.
1.01	9.30	114	.07	.06	.00	252.	1.01	21.30	258	.02	.02	.00	83.
1.01	9.35	115	.07	.06	.00	253.	1.01	21.35	259	.02	.02	.00	83.
1.01	9.40	116	.07	.06	.00	253.	1.01	21.40	260	.02	.02	.00	83.
1.01	9.45	117	.07	.06	.00	253.	1.01	21.45	261	.02	.02	.00	83.
1.01	9.50	118	.07	.06	.00	254.	1.01	21.50	262	.02	.02	.00	83.
1.01	9.55	119	.07	.06	.00	254.	1.01	21.55	263	.02	.02	.00	83.
1.01	10.00	120	.07	.06	.00	254.	1.01	22.00	264	.02	.02	.00	83.

1.01	10.05	121	.07	.06	.00	255.	1.01	22.05	265	.02	.02	.00	83.
1.01	10.10	122	.07	.06	.00	255.	1.01	22.10	266	.02	.02	.00	83.
1.01	10.15	123	.07	.06	.00	255.	1.01	22.15	267	.02	.02	.00	83.
1.01	10.20	124	.07	.06	.00	255.	1.01	22.20	268	.02	.02	.00	83.
1.01	10.25	125	.07	.06	.00	256.	1.01	22.25	269	.02	.02	.00	83.
1.01	10.30	126	.07	.06	.00	256.	1.01	22.30	270	.02	.02	.00	83.
1.01	10.35	127	.07	.06	.00	256.	1.01	22.35	271	.02	.02	.00	83.
1.01	10.40	128	.07	.06	.00	256.	1.01	22.40	272	.02	.02	.00	83.
1.01	10.45	129	.07	.06	.00	257.	1.01	22.45	273	.02	.02	.00	83.
1.01	10.50	130	.07	.06	.00	257.	1.01	22.50	274	.02	.02	.00	83.
1.01	10.55	131	.07	.06	.00	257.	1.01	22.55	275	.02	.02	.00	83.
1.01	11.00	132	.07	.06	.00	257.	1.01	23.00	276	.02	.02	.00	83.
1.01	11.05	133	.07	.06	.00	257.	1.01	23.05	277	.02	.02	.00	83.
1.01	11.10	134	.07	.06	.00	258.	1.01	23.10	278	.02	.02	.00	83.
1.01	11.15	135	.07	.06	.00	258.	1.01	23.15	279	.02	.02	.00	83.
1.01	11.20	136	.07	.06	.00	258.	1.01	23.20	280	.02	.02	.00	83.
1.01	11.25	137	.07	.06	.00	258.	1.01	23.25	281	.02	.02	.00	83.
1.01	11.30	138	.07	.06	.00	258.	1.01	23.30	282	.02	.02	.00	83.
1.01	11.35	139	.07	.06	.00	258.	1.01	23.35	283	.02	.02	.00	83.
1.01	11.40	140	.07	.06	.00	258.	1.01	23.40	284	.02	.02	.00	83.
1.01	11.45	141	.07	.06	.00	259.	1.01	23.45	285	.02	.02	.00	83.
1.01	11.50	142	.07	.06	.00	259.	1.01	23.50	286	.02	.02	.00	83.
1.01	11.55	143	.07	.06	.00	259.	1.01	23.55	287	.02	.02	.00	83.
1.01	12.00	144	.07	.06	.00	259.	1.02	0.00	288	.02	.02	.00	83.
									SUM	32.37	31.39	.98	130166.
										(822.)	(797.)	(25.)	(3685.89)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3915.	1376.	452.	452.	130137.
CMS	111.	39.	13.	13.	3685.
INCHES		24.61	32.33	32.33	32.33
MM		625.04	821.28	821.28	821.28
AC-FT		682.	896.	896.	896.
THOUS CU M		841.	1106.	1106.	1106.

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	99.00	98.42	103.60
STORAGE	40.	36.	77.
OUTFLOW	1.	0.	118.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.04	102.63	0.00	68.	18.	0.00	19.00	0.00
.05	103.03	0.00	71.	43.	0.00	18.25	0.00
.06	103.27	0.00	74.	75.	0.00	17.25	0.00
.07	103.55	0.00	77.	112.	0.00	16.75	0.00
.08	103.79	.19	79.	166.	1.25	16.50	0.00
.10	104.14	.54	83.	268.	2.08	16.33	0.00
.20	104.71	1.11	89.	731.	5.25	16.17	0.00
.50	105.51	1.91	98.	1894.	8.75	16.08	0.00
1.00	106.37	2.77	108.	3839.	12.92	16.08	0.00

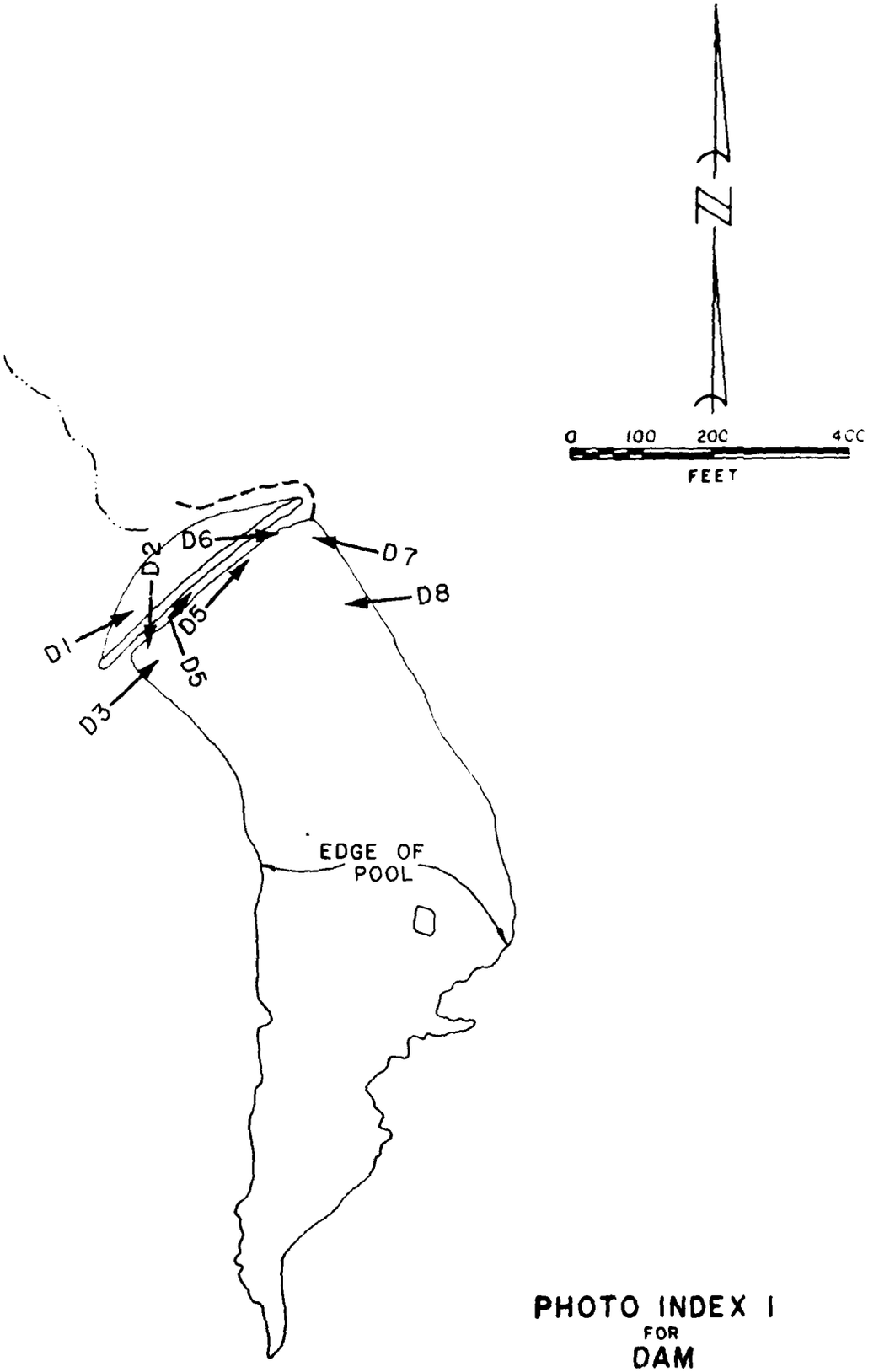
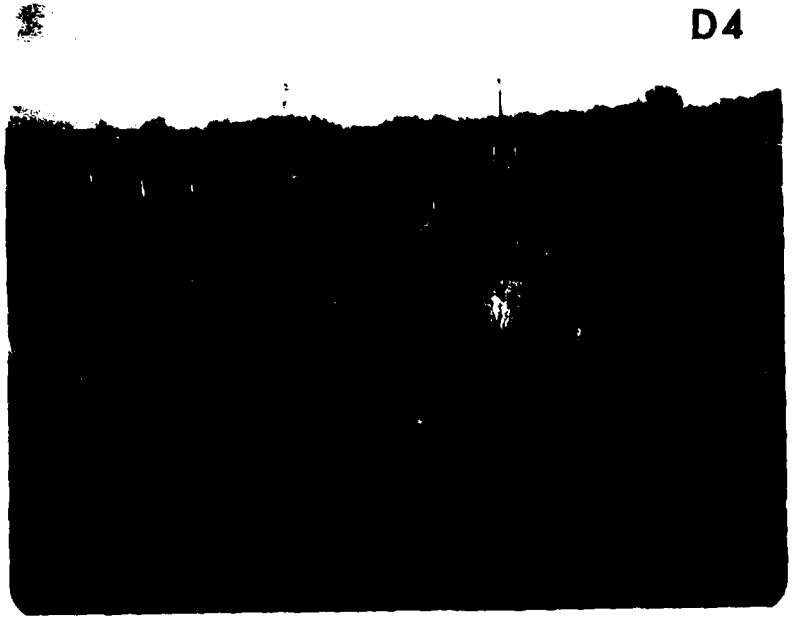


PHOTO INDEX 1
FOR
DAM

ROBERT SCHULTE DAM
ST. CHARLES COUNTY, MO.
DECEMBER 1978

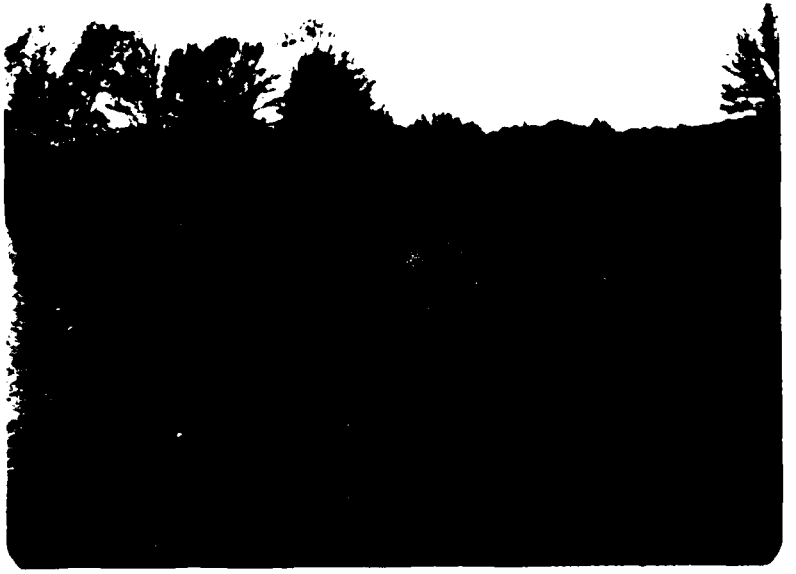
PREPARED BY
REITZ & JENS, INC.



DAM

D7

D8



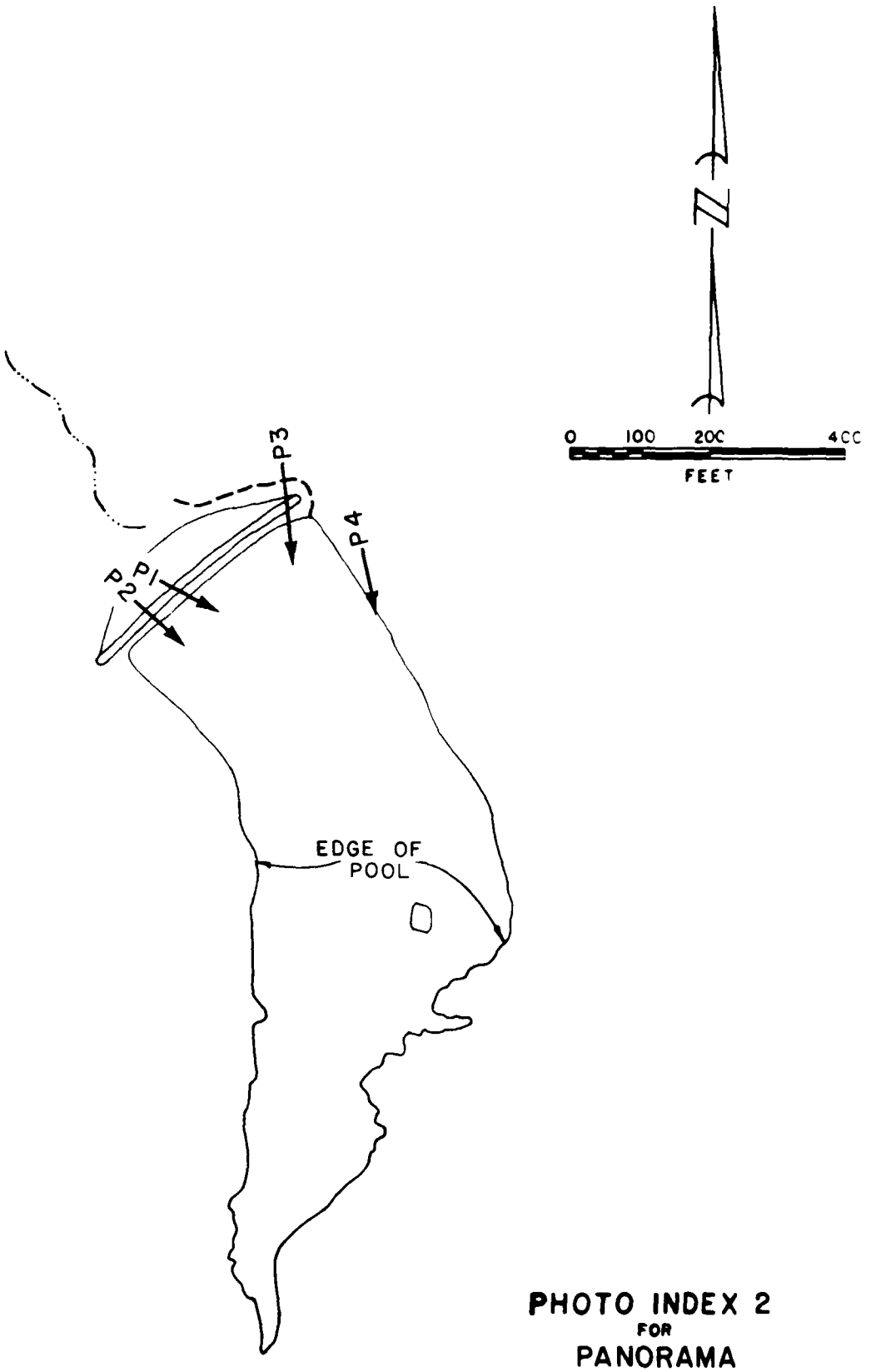
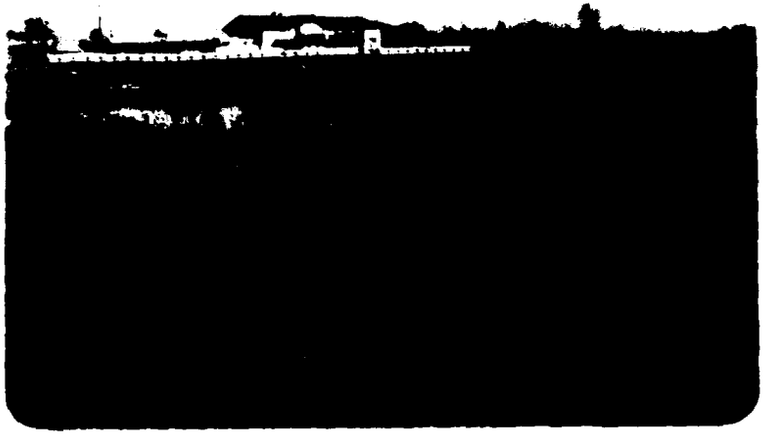


PHOTO INDEX 2
FOR
PANORAMA

ROBERT SCHULTE DAM
ST. CHARLES COUNTY, MO.
DECEMBER 1978

PREPARED BY
REITZ & JENS, INC.

P1



P2

P3

P4

PANORAMA

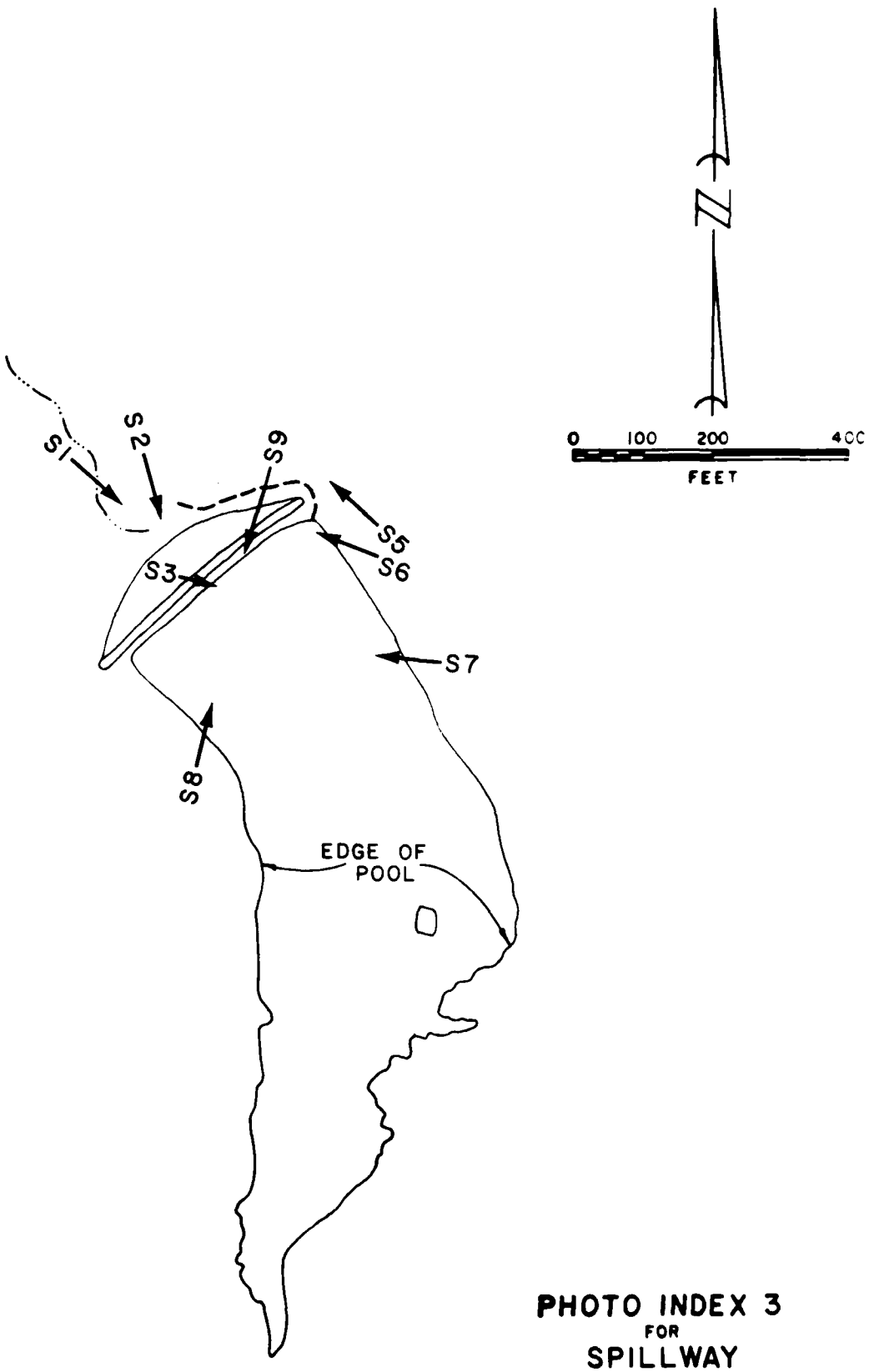


PHOTO INDEX 3
FOR
SPILLWAY

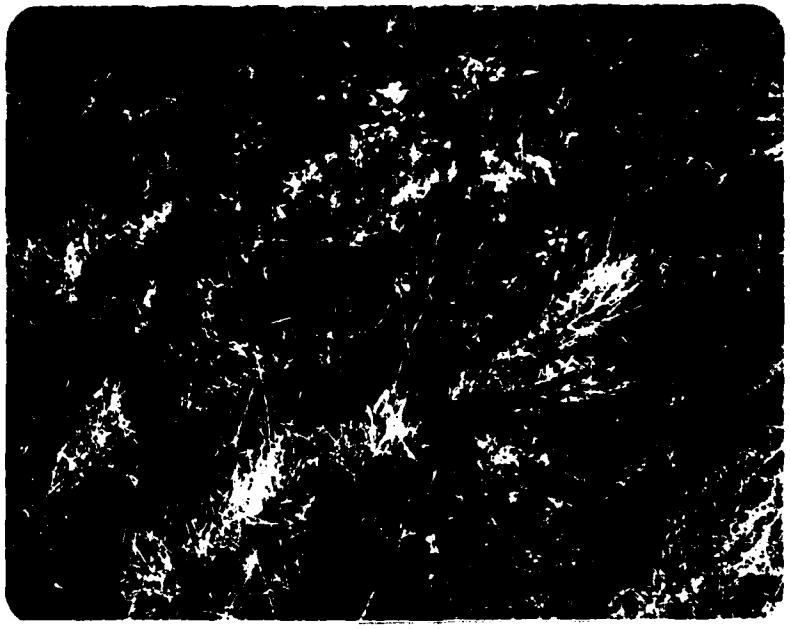
ROBERT SCHULTE DAM
ST. CHARLES COUNTY, MO.
DECEMBER 1978

PREPARED BY
REITZ & JENS, INC.

S4

S1

SPILLWAYS



S8

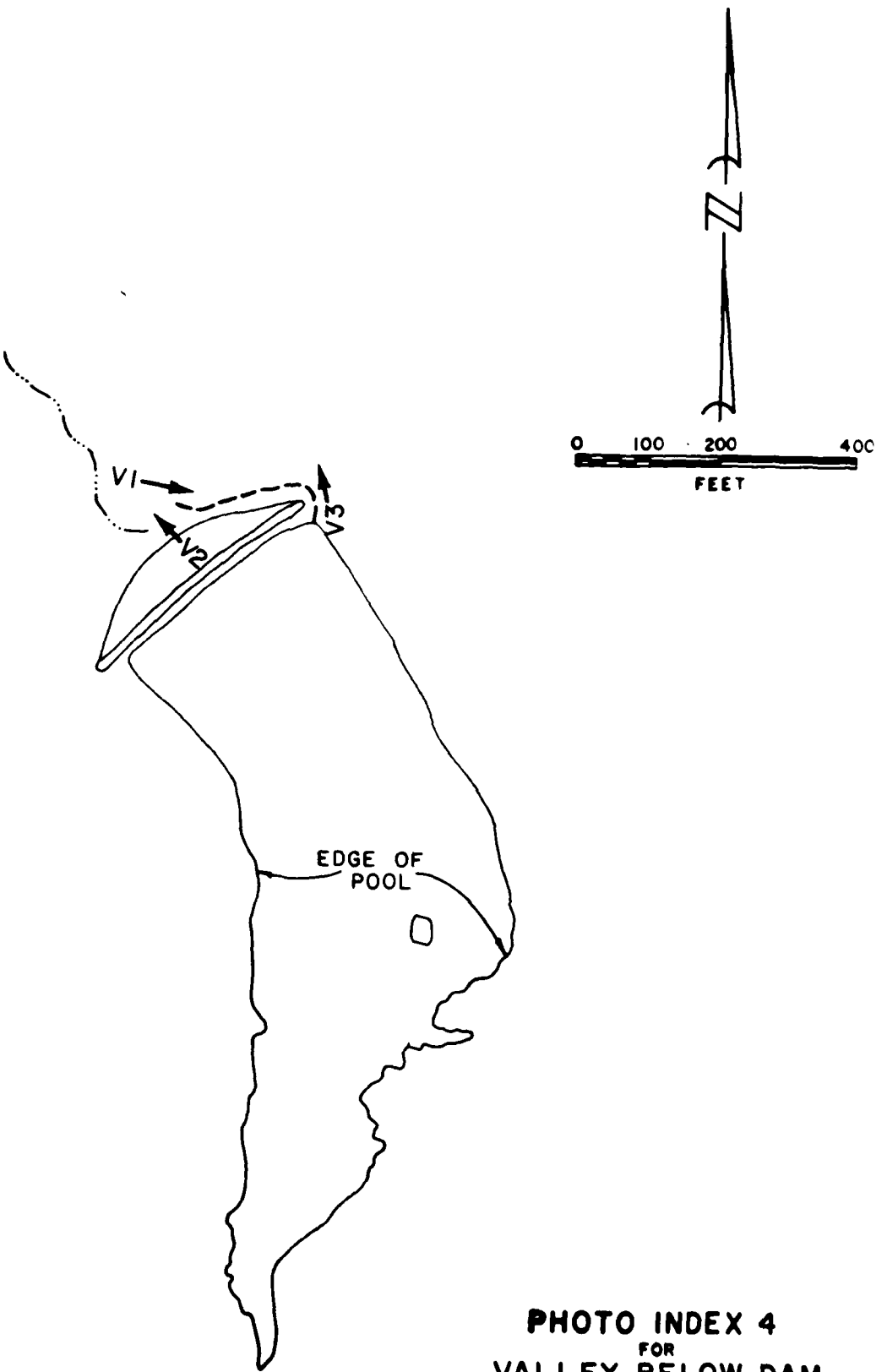
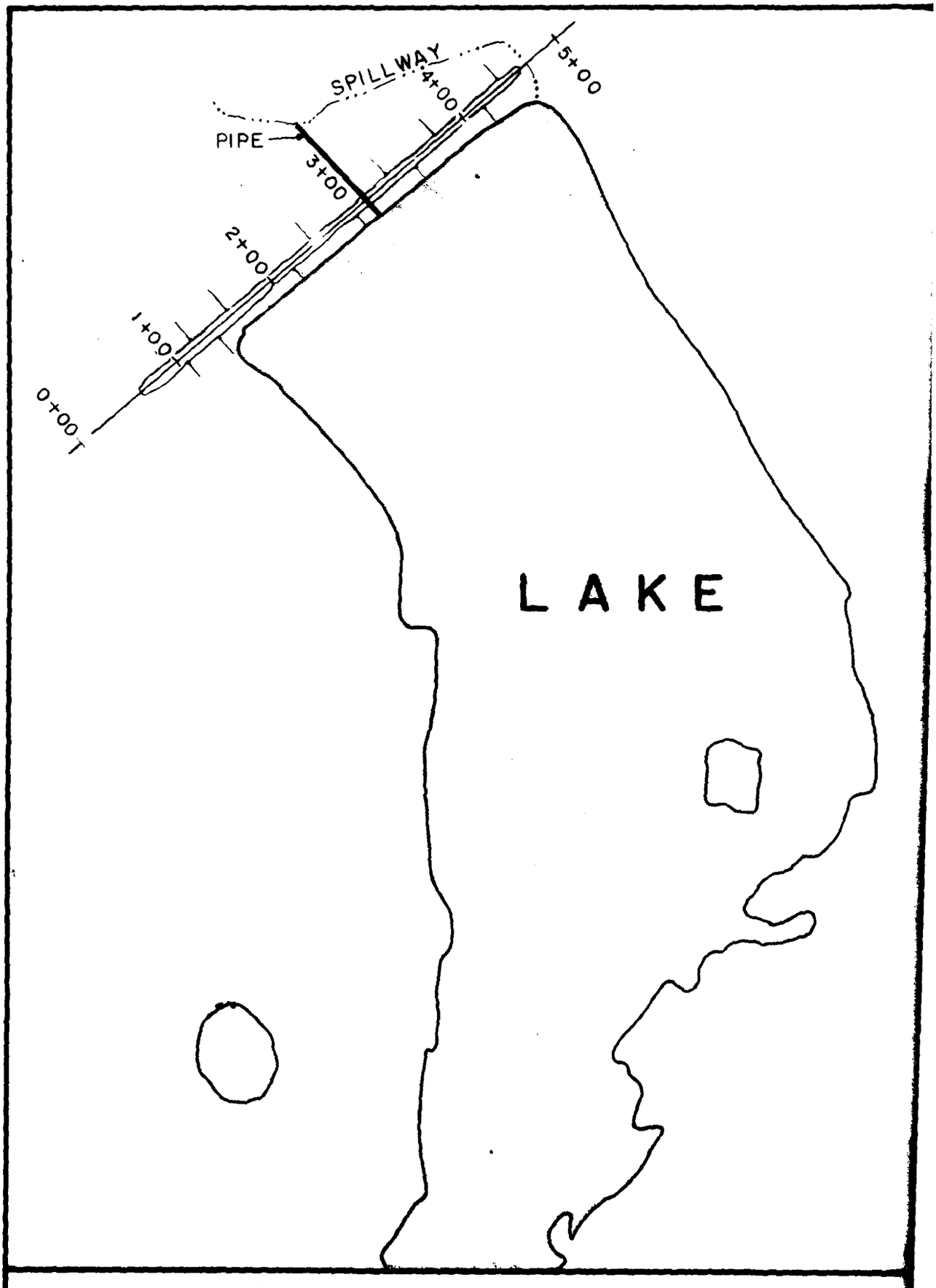


PHOTO INDEX 4
FOR
VALLEY BELOW DAM

ROBERT SCHULTE DAM
ST. CHARLES COUNTY, MO.
DECEMBER 1978

PREPARED BY
REITZ & JENS, INC.

VALLEY BELOW DAM



FINAL SURVEY	BY	DATE
NOTE BOOK NO	SURVEYED	
	PLOTTED	
	TEMPLATE	
	AREAS	
	AREAS CHECKED	

PLAN OF DAM AND SPILLWAYS

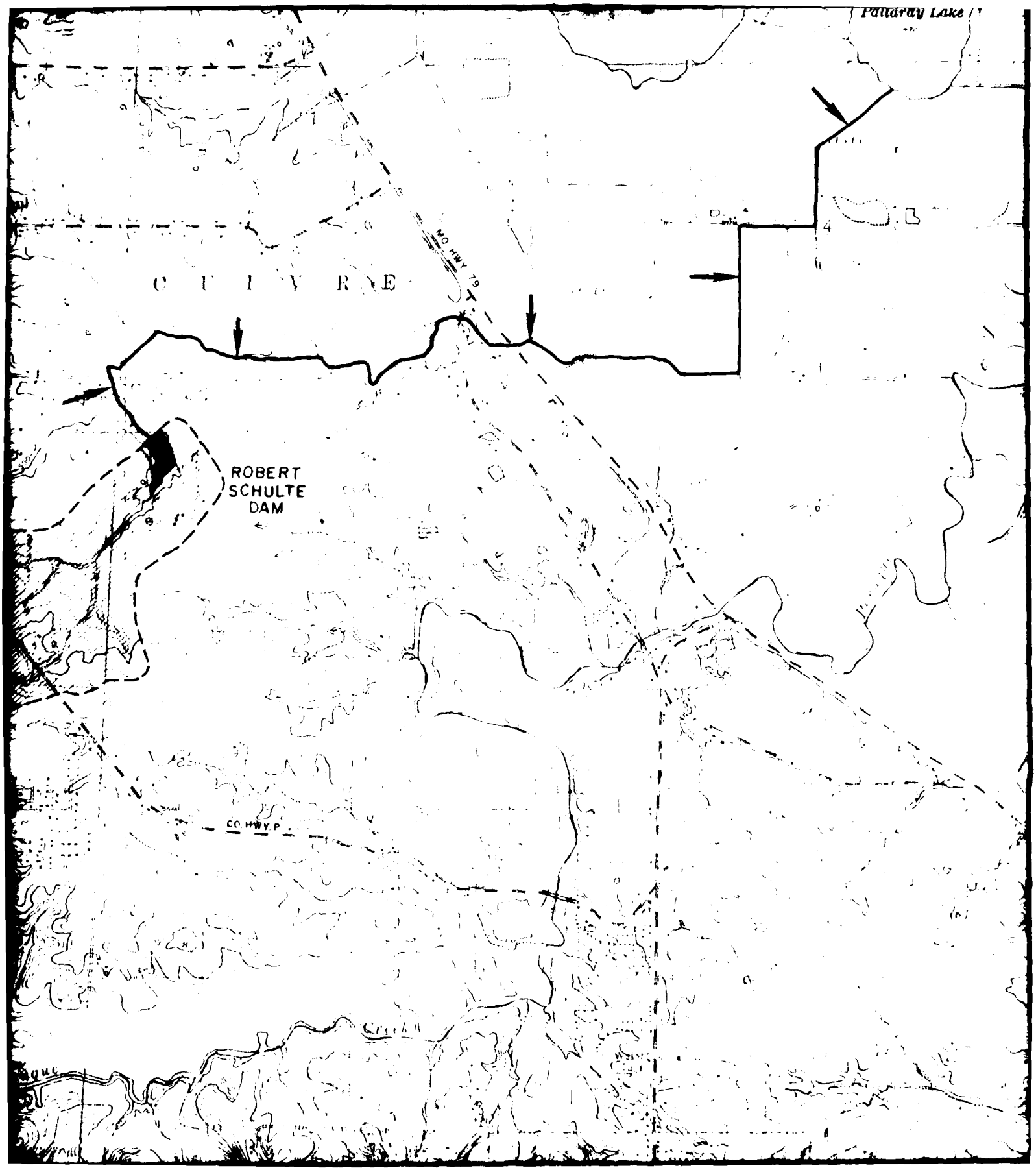
12

PLAN OF LAKE

0 100 200 400

OF LAKE

200 400 FT.


Pattaray Lake
MO HWY 79
ROBERT
SCHULTE
DAM
CO HWY P

PLAN OF DAM AND SPILLWAYS

0 50 100 200 300 FT

ORIGINAL SURVEY

NOTE BOOK NO

SURVEYED BY

PLOTTED

TEMPLATE

AREAS

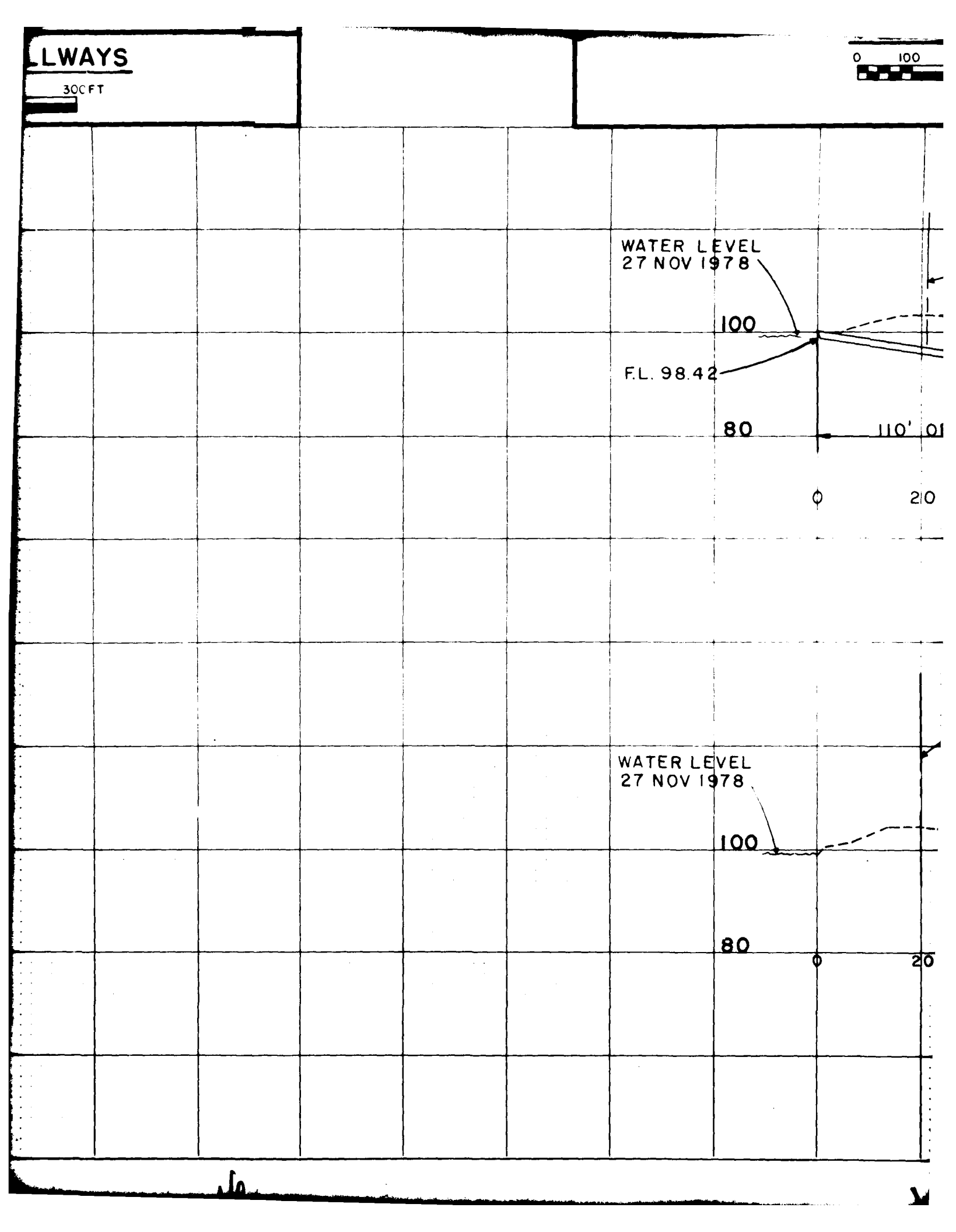
AREAS CHECKED

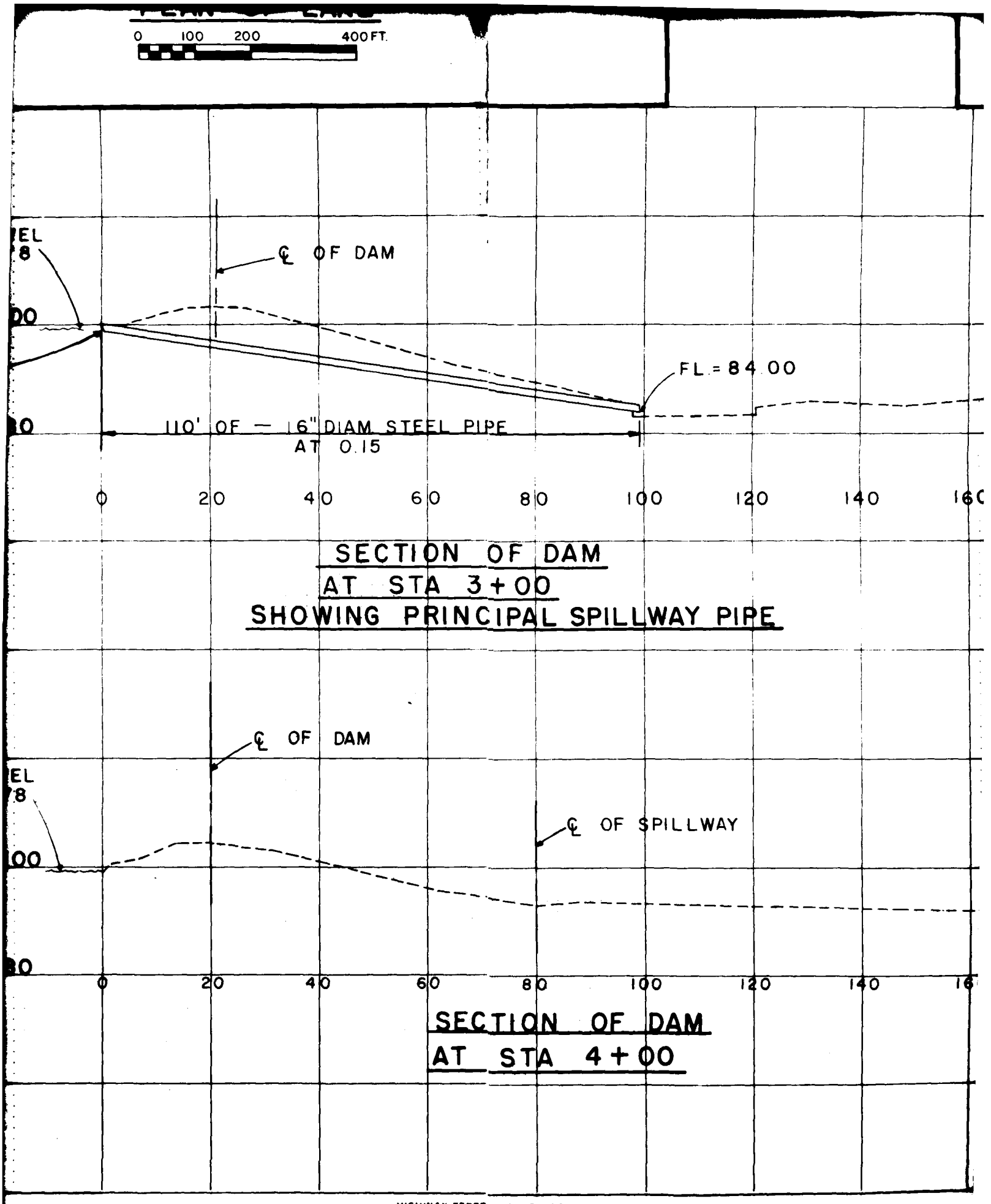
DATE

LWAYS

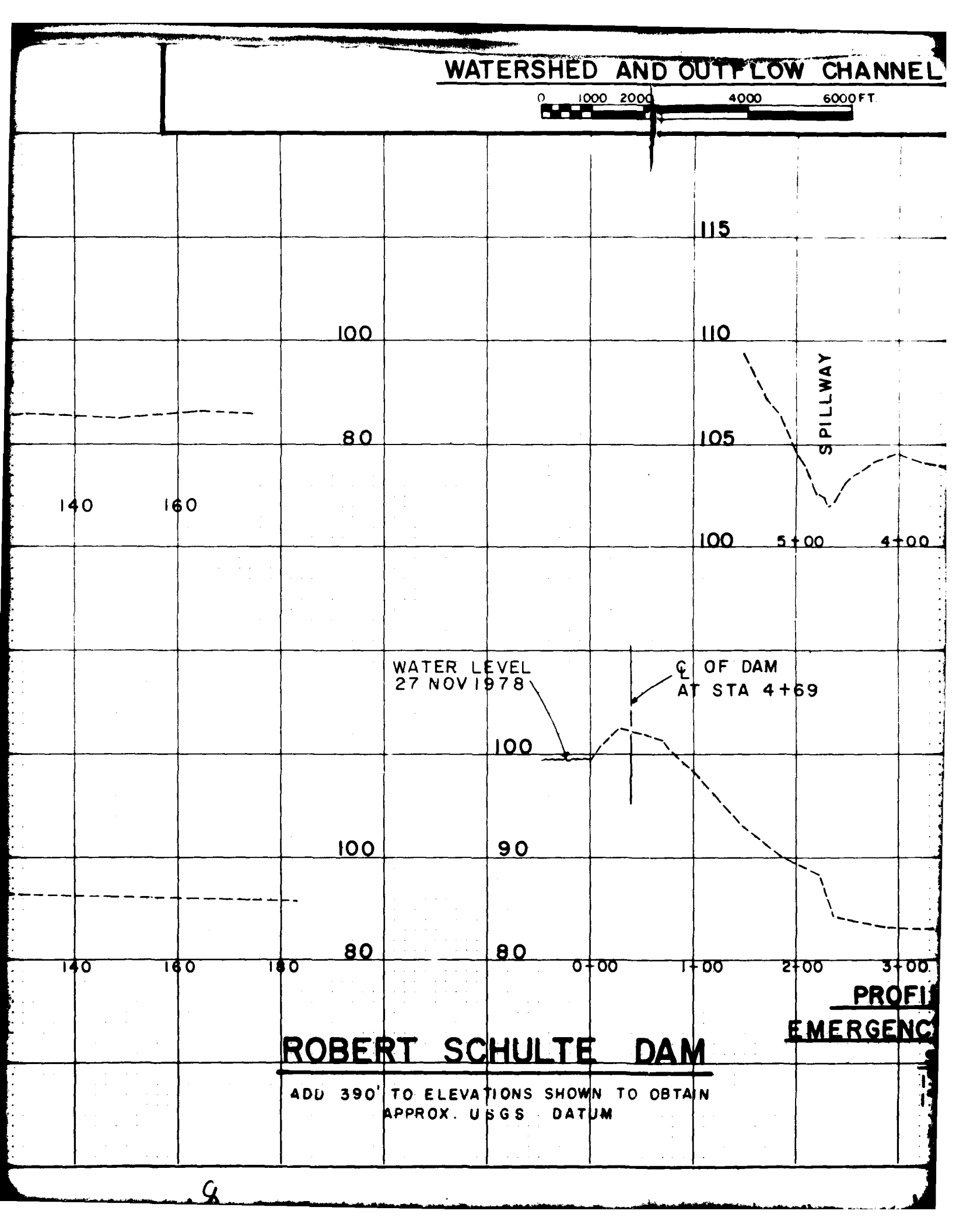
300 FT

0 100





HIGHWAY FEDERAL AID SHEET
PLATE 4-SINGLE PLAN AND CROSS SECTION-LINE & DOT
TELEDYNE NATIONAL TRACING PAPER


WATERSHED AND OUTFLOW CHANNEL
0 1000 2000 4000 6000 FT
115
110
100
105
80
SPILLWAY
140
160
100
5+00
4+00
WATER LEVEL
27 NOV 1978
℄ OF DAM
AT STA 4+69
100
100
90
80
80
140
160
180
0+00
1+00
2+00
3+00
PROFI
EMERGENC
ROBERT SCHULTE DAM
ADD 390' TO ELEVATIONS SHOWN TO OBTAIN
APPROX. USGS DATUM

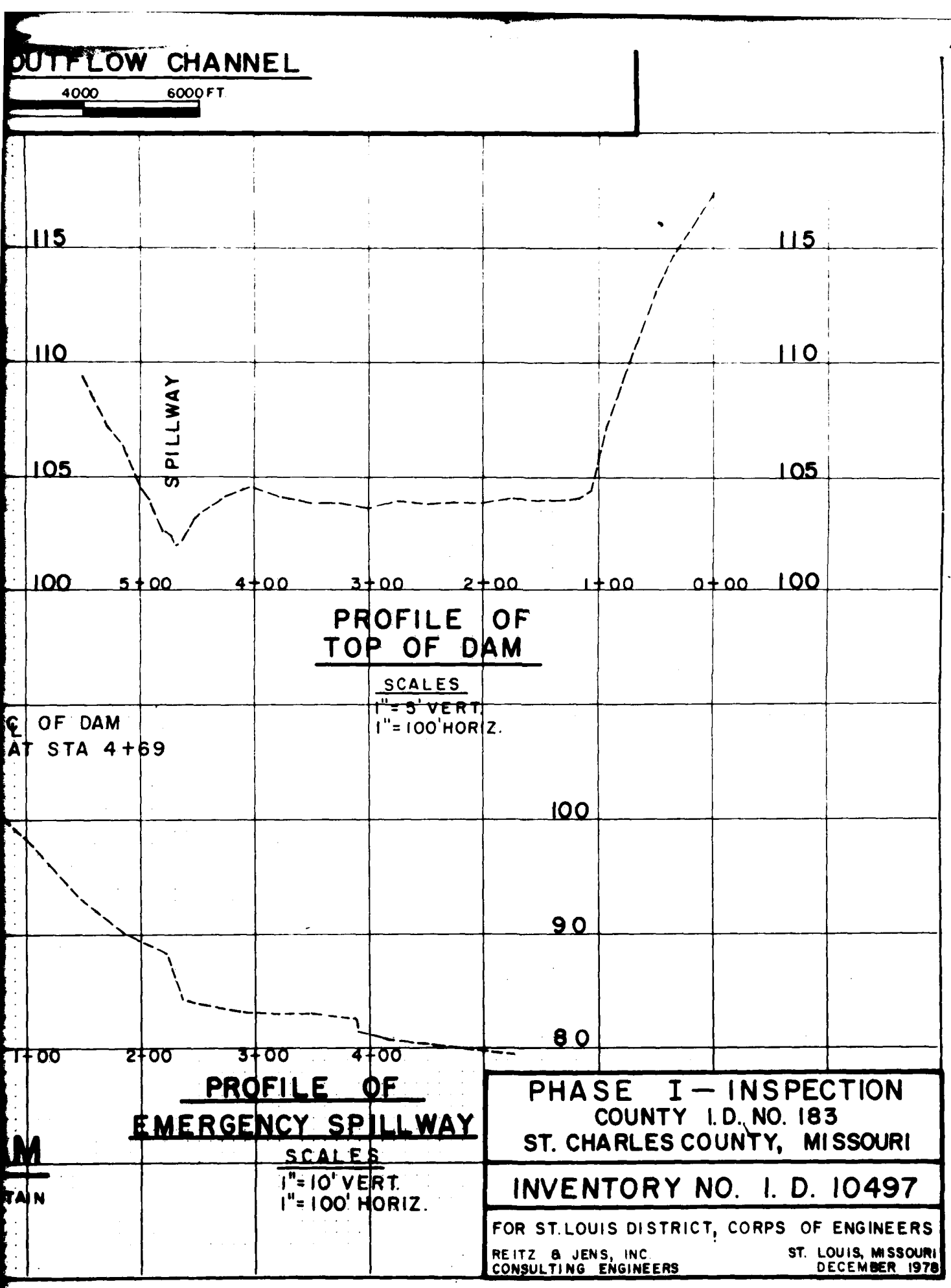

OUTFLOW CHANNEL
4000
6000 FT
115
110
105
100
SPILLWAY
5+00
4+00
3+00
2+00
1+00
0+00
PROFILE OF TOP OF DAM
SCALES
1" = 5' VERT.
1" = 100' HORIZ.
℄ OF DAM AT STA 4+69
100
90
80
1+00
2+00
3+00
4+00
PROFILE OF EMERGENCY SPILLWAY
SCALES
1" = 10' VERT.
1" = 100' HORIZ.
PHASE I — INSPECTION
COUNTY I.D. NO. 183
ST. CHARLES COUNTY, MISSOURI
INVENTORY NO. I. D. 10497
FOR ST. LOUIS DISTRICT, CORPS OF ENGINEERS
REITZ & JENS, INC
CONSULTING ENGINEERS
ST. LOUIS, MISSOURI
DECEMBER 1978

PLATE 3


ATE
LME